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IS 7209 (1974): General requirements for blast hole drilling rigs [MED 21: Diamond Core and Waterwell Drilling]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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Indian Standard

GENERAL REQUIREMENTS FOR BLAST HOLE DRILLING RIGS

1. Scope — Covers the general requirements for blast hole drilling rigs.

2. Functions and Constructional Details

2.1 The drill is used to drill small diameter shallow holes for purposes of blasting. The holes will not be cased and as soon as the required number of holes are drilled at the specified spacing pattern, blasting will be carried out. Scavenging of cuttings may be either by mud flush pumping or by high pressure air delivered by a suitable air compressor.

2.2 The functions and the constructional details of the various units are furnished below (see Fig. 1). They are intended to be typical only and do not constitute a specific recommendation but are only a guideline for the manufacturer and the user of the drilling rig.

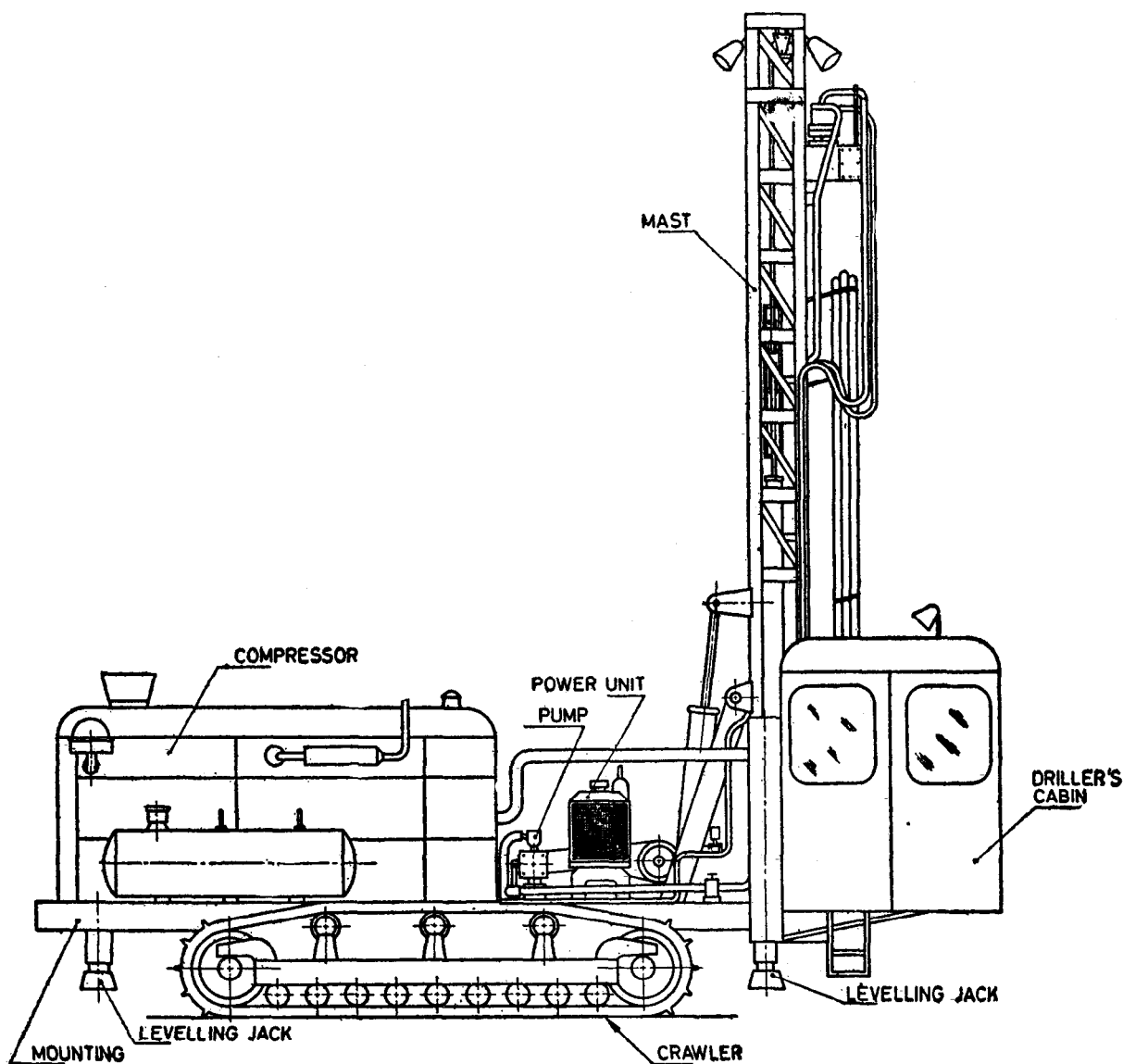


FIG. 1 BLAST HOLE DRILLING RIG

Adopted 25 February 1974

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Gr 3

2.2.1 Mast — Mast shall be constructed either of steel tubing or structural steel conforming to either IS : 266-1969 'Specification for steel tubes for structural purposes (*second revision*) ' or IS : 1161-1968 'Specification for structural steel (standard quality) (*fourth revision*) '. The material shall be capable of handling the maximum desired load without distortion, the factor of safety being not less than 2.2 in any case. The mast shall be made up of horizontal sections with cross-bars tied to the sections at an interval of not more than 3 to 3.5 metres. They shall be properly welded with no cracks in welding. The final shape of the mast shall be correct to the requirement with clear working height to handle the drilling string and with sufficient width to accommodate handling of drilling bits and casing pipes. The mast shall be actuated by one or more double acting hydraulic cylinders with safety checks, to either raise or lower it. A mechanical lock shall be provided to hold the mast in vertical position. It shall be so designed that the drill may be readily positioned to drill vertical holes or holes at limited specified angles with requisite increments in the angle. The mast shall accommodate the magazine and travel head. The rig shall be capable of being shifted from one hole to the other (which are near) with the mast in erected position.

2.2.2 Rotary table — Travelling rotary box-operated hydraulic motor or by any other suitable method with variable speeds shall be provided to obtain the right speed for every job. Quick changeover to different speeds shall be possible to meet changing conditions. Alternately, rotary drive may be provided through conventional right-angle drive case with a drive shaft and travelling head. In either case a suitable water swivel shall be provided in units employing the mud slush principle to ensure leakproof, trouble-free operation and easy repair works. The swivel hose shall be of the high pressure flexible rubber type having the required diameter and adequate length and shall have adequate abrasive resistance to ensure reasonably long life.

2.2.3 Transmission — Transmission shall have sufficient range of forward speeds and reverse speeds to give variable rotational speeds to the drilling string for different strata conditions and different hoisting speeds for different loads. Transmission may be either of the conventional type of gear shift through linkages or power shift type.

2.2.4 Pump or compressor

2.2.4.1 In the case of mud drilling, the mud pump shall be capable of quickly scavenging the cuttings to obtain maximum drilling rate. The pump shall be designed to deliver the maximum discharge of the mud fluid at the desired pressure to have good results. It shall either be a conventional reciprocating pump or of any other suitable design with suitable drives from either the main power unit or from a separate power source. There shall be an independent control for the pump and shall be provided with suction hose, pipe lines and delivery hoses. A suitable water swivel shall be provided. There shall also be a pressure-relief valve to release the excessive pressure if produced. All the suction hoses used in drilling rigs shall be of such a material as to withstand the abrasive action of the circulating fluid.

2.2.4.2 In the case of dry drilling with compressed air, a suitable compressor unit to supply adequate quantity of high pressure air to remove the cuttings shall be provided. The compressor shall be fitted in the rig itself and be driven by its own power unit. A suitable control to operate the compressor, valves and air line pipes and hoses shall be provided.

2.2.5 Power unit — Power to drive the different units, namely, track box drive, mud pump, etc, shall be made available either from a single unit with hydraulic motors coupled to it to drive individual units or separate power units for each drive with independent controls. Industrial type diesel engine or engines of continuous rating or electric motor or motors may be suitably fitted. In the case of diesel engines necessary starting arrangements with self-starter and battery system and suitable lubricating and cooling arrangements shall be provided. Necessary gauges to indicate the speed, lubricating oil pressure, battery charging, etc, shall be provided at convenient locations. A fuel tank of suitable capacity shall be provided. In the case of electric motor or motors, they shall be totally enclosed fan-cooled types, continuously rated, with starters and switch gears. The whole system shall be enclosed in a weather-proof cabin. The motor or motors shall be suitable to be driven from 400 V ac mains. There may be two motors for the tracks, and one for the mud pump. In all the cases they should develop adequate power to drive the units efficiently and economically. Alternatively, the electric motors shall drive a hydraulic pump which in turn will drive the hydraulic track motors for movement of the machine.

2.2.6 Controls — The controls should be provided:

- a) to start the power unit,
- b) for erection of the main supporting jacks,
- c) for raising and lowering of mast,
- d) for hoisting and lowering the main line,
- e) for hoisting and lowering of the sand line,

- f) to give rotary drive to the drilling string,
- g) to drive the mud slush pump or the compressor,
- h) to move the rig from one place to another,
- j) for lighting system, and
- k) to drive the magazine.

2.2.6.1 All the above controls and any other controls that are required shall be grouped together in a convenient place and shall be located within the reach of the operator. The controls shall have provision for easy and quick operation and the entire operation shall be visible to the operator from his cabin.

2.2.7 Lighting system — Generally drilling operations are carried out during day and night. To enable round-the-clock operation, the entire rig shall be adequately illuminated. In the case of the rig equipped with diesel engine or engines, the power for lighting shall either be from the main engine or from any auxiliary equipment. In the other case where the electric power is available and the rig equipped with electrical motors, the power for the lights shall be tapped from the electrical main and in the case of rigs supplied to mines, the voltage shall be either 110 or 24 V. Panel lights for the gauges may also be provided. Suitable control switches shall be provided.

2.2.8 Mounting — The rig platform shall be made up of welded structural steel and shall provide extra margin of strength to take up all vibrations and shocks while drilling and shifting of the drill. Two types of mounting are recommended as follows.

2.2.8.1 Crawler mounted

- a) *Diesel driven* — The rig platform shall be mounted on crawlers, self-propelled and diesel driven. Power to the tracks may be obtained from the main power unit through hydraulic motors by reduction gears with chain drive. They shall be controlled by valves and shall be capable of independent movement.
- b) *Electric driven* — Mounted on crawlers, the tracks shall be actuated by either the main power unit through hydraulic motors and valves or by separate motor/motors driven through friction clutches or chain driven or by hydraulic motors.

2.2.8.2 Truck mounted — Mounted on a self-propelled truck with pneumatic wheels with an independent power unit to drive the rig.

2.2.8.3 In either case all the different units shall be grouped together systematically in the platform and shall provide sufficient working space for inspection and repairs. All the moving parts shall have adequate lubricating arrangements.

2.2.9 Magazine — There shall be a drill pipe magazine made out of an all steel welded structure of robust construction mounted on the mast. It shall accommodate sufficient number of requisite length of drill pipes and shall be readily available for adding to the drill string. The magazine shall move and position the drill pipes over the hole for adding to the drill string. The drive to the magazine shall be through hydraulic motors of adequate capacity.

2.2.10 Pull down — There shall be a pull down of requisite maximum pressure to drive the bit down the hole to obtain maximum feed and thus higher drilling rate. It may be a positive wire rope hydraulic pull down or a chain pull down, or otherwise suitably driven, for maximum efficiency. The operator shall be able to apply the right pressure according to the need.

2.2.11 Driller's cabin — An enclosed all weather metal cab, equipped with clear view windows to have a complete vision of all the operations shall be mounted on the rig at a convenient place. All the controls shall be grouped together and positioned at the driller's place within his reach for easy and quick operation. Suitable lighting arrangement shall also be made at the cabin.

2.2.12 Levelling — Levelling of the machine shall be done hydraulically by means of three levelling jacks mounted at the front and rear and shall have independent controls.

2.2.13 Tools and accessories — The drilling rig shall be provided with the complete set of all operating equipments and small hand tools for carrying out repairs to both power units and other equipments. The following tools and accessories that are ordinarily to be supplied along with the drill shall be included but this is variable according to the need of the user of the drilling rig:

- a) Drill bits of various sizes and types to drill through the different soil formations;
- b) Sufficient numbers of drill rods to cover the rated capacity of the drill;

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- c) Drill rod hoisting flange;
- d) Drill rod slip;
- e) Spirit level;
- f) Chain wrenches;
- g) Adjustable wrench;
- h) Set of files — flat, round, half-round, etc (rough and smooth);
- j) Cold chisel;
- k) Centre punch;
- m) Hammer;
- n) Pliers;
- p) Screw driver;
- q) Adjustable spanner;
- r) Set of double-ended spanners;
- s) Set of ring spanners;
- t) Set of box spanners;
- u) Grease-gun;
- v) Oil can;
- w) Steel tape;
- y) Hacksaw frame with blades; and
- z) Set of allen keys.

3. Information to be Supplied by the Purchaser

3.1 When enquiring or ordering drilling rigs, the user shall furnish the following information:

- a) Geographical history, in general, of the location of sites where holes are to be drilled;
- b) Anticipated formation of strata where the holes are to be drilled;
- c) Maximum depth and diameter to be drilled;
- d) The mast height and the wire string capacity and their dimensions, if so desired;
- e) Pump delivery capacity and maximum discharge pressure;
- f) Mobility for the entire unit (.crawler, truck.);
- g) The available power to drive the rig, that is, whether electric power is available or not;
- h) Maximum power output of the power unit/units and speed;
- i) The type of explosives to be used on the holes for blasting and the method of blasting; and
- k) Any other special features that are required.

4. Information to be Furnished by the Supplier

4.1 The following information shall be furnished by the supplier:

- a) The performance of the rig in respect of the following:
 - 1) Maximum diameter and depth that can be drilled;
 - 2) The approximate rate of drilling under normal specified conditions;
 - 3) The pump capacity, namely the maximum discharge and pressure of the pump; and
 - 4) Any special features in the construction to drill through hard soil conditions;
- b) The maximum load handling capacity, its constructional details and clear lifting capacity;
- c) (1) The draw works type and its full capacity, and
 - 2) Factor of safety on wire rope at full load;

- d) The capacity of the main line and sand line brakes;
- e) The number of variable rotational and hoisting speeds;
- f) The number and capacity of the mast raising cylinders;
- g) The hydraulic system details and the motor capacity;
- h) Mobility of the rig with reference to alternative arrangements that can be made while effecting delivery of the rig;
- j) The prime mover and its transmission ratios;
- k) Complete literature with illustrations of different units; and
- m) Any other special features that are incorporated in the design and construction which shall give increased performance characteristics to the drilling rig.

5. Testing

5.1 Object — The object of testing the drilling rig is to determine the efficiency of the drill in terms of the maximum diameter and depth of drilling and rate of penetration under specified soil conditions. This shall be subject to agreement between the supplier and the purchaser.

5.2 Duration of Test — The duration of the test shall be sufficient to obtain accurate and consistent results.

5.3 Observations During the Test — During the entire period of the test, careful observation shall be made in regard to the following:

- a) Easy and quick movement of the rig even when the mast is in the erected position;
- b) The quickness in erection of drill and commencing the drilling operations without loss of time;
- c) The ease of its accessibility and quick operation of the controls;
- d) Quick addition of string;
- e) The diameter of the hole drilled and its depth;
- f) The rate of drilling through different formations.
The depths at an interval of at least 15 minutes shall be noted and the relative time taken shall be observed for every unit of depth;
- g) The capacity of the mast and the draw works;
- h) The capacity of the pump to the extent of its quick clearance of the cuttings, the pressure and discharge;
- j) Undue shock, hammering, vibrations or other mechanical defects;
- k) Lubrication of all the units; and
- m) Operational suitability and the controls.

EXPLANATORY NOTE

The blast holes are used for blasting purposes to loosen the over burden for easy removal by other means. These rigs are used in hard areas, namely, rock, soft rock or sandstone.

This standard has been prepared to provide guidance to both the manufacturer and the users of blast hole drilling rigs. This standard is not intended to be restrictive in character and is subject to agreement between the manufacturer and the user. Some of the requirements of this standard may either be modified or made more elaborate.

In this standard certain minimum technical requirements are specified for satisfactory performance of the rigs. Among the various requirements covered in the standard are those pertaining to the constructional details of the drill in general and with relation to the condition of the soil.